At relatively short distances gravitation predominates, and the net motion is inward. Since the gravitational motion decreases with distance, while the outward progression remains constant, the opposing motions reach equality at some greater distance, which we will call the gravitational limit. Beyond this distance the net motion is outward, increasing with distance, and approaching unity (the speed of light) at extreme distances.

(This theoretical pattern of net speeds is verified observationally by measurements of the Doppler effect in the radiation received from the distant galaxies.)

Dewey B. Larson
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ISUS CONFERENCE THIS SUMMER

The Thirteenth Annual Conference of the INTERNATIONAL SOCIETY OF UNIFIED SCIENCE (ISUS) will be held August 12-13, 1988 in Portland, Oregon. The conference will start at 9:00 a.m. August 12 and will end with the dinner banquet around 10:00 p.m. August 13.

Sessions will be held in the Meeting Room of the Gregory Heights Branch of the Multnomah Country Library at 7921 N.E. Sandy Blvd., Portland, Oregon. This location is close to the Jade Tree Motel, downtown Portland and Mr. Larson's house. We are all looking forward to having a great conference in the home city of Mr. Larson and we look forward to seeing you there.

MOTEL RESERVATIONS NEED TO BE MADE SOON!

The Jade Tree is a modern and very nice and clean motel with luxury rooms. There are a number of good restaurants nearby and the motel is only a few miles from the Portland Airport.

Three types of rooms set aside for us are:
1. Rooms with two twin beds @ $33.79 each per night (inc. tax). These twin-bed rooms would be suitable for sharing for 2 persons thus reducing the cost to $16.90 each person.
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3. Rooms with two double beds @ $42.50 per night. (suitable for two large persons sharing).

The Jade Tree has agreed to hold these rooms for us until they receive a deposit equal to the first nights stay, at which time the room will become reserved. After July 12 the rooms cannot be held, so please send in your deposit as soon as possible and definitely before July 12.

Please send your deposit directly to the Jade Tree either by telephoning and using your credit card or by mailing a check or money order directly to them. Their address is:

Jade Tree Motel
3939 NE. Hancock Street
Portland, Oregon 97212

Phone: (503) 288-6891
Manager's name is Susie

We suggest you reserve a room for the nights of August 11, 12 and 13. The Jade Tree offers you a free night on Sunday, August 14 if you wish to stay over after the conference.

We are all looking forward to having a great conference in the home city of Mr. Larson and we look forward to seeing you there.
Dear Frank,

The following is a Letter to the Editor of Reciprocity

I read with considerable interest the letter from Dewey Larson in the Autumn, 1987 Reciprocity. I concur wholeheartedly with his central theme. which is that modern theory - most notably quantum mechanics and relativity - have produced excellent mathematical solutions to the large volume of experimental data available, but have not produced a satisfyingly consistent conceptual framework. New mathematics is regularly discovered or newly applied to new data, after which the theorists scramble around to find a way to fit this new mathematics into the prevailing theory. If the mathematics can not be made to fit, then the theory is expanded in some way.

I also agree with Larson, as I am sure most members of ISUS will, that the Reciprocal Theory provides a conceptual framework far superior to that available in any or all current theories. In fact, as a conceptual theory, the Reciprocal Theory may go beyond any physical theory ever proposed by anyone in recorded history. This is a very profound statement.

The question must then arise as to why after thirty years of exposure, the Reciprocal Theory has had an extremely limited acceptance. There are several reasons for this given by Larson in some of his books and also by members of ISUS. These reasons usually center on the fact that physicists have a tremendous amount of time, money, prestige, etc. invested in current theories and since acceptance of the Reciprocal Theory may require the wholesale scrapping of current theory, that these physicists are unwilling to even consider such a radical change. It is also suggested that physicists have a difficult time making the conceptual leaps required by the Reciprocal Theory. I am sure that there is some validity to these arguments.

I would like, however, to suggest another possibility that may be somewhat less adversarial. The vast majority of physicists today spend their time doing calculations. Since conceptual theoretical leaps happen only rarely, it is necessary for physicists to spend the rest of their time doing something productive. What this usually means is that the physicist will extend calculations for some property or process into a new area. An example would be the computation of some property of an element or compound, that has already been done for many other compounds, or computing scattering cross sections for a new energy level. This generally requires the use of sophisticated mathematical techniques and little or no use of the conceptual framework of the process. Therefore what most physicists are looking for in a theory is some conceptual framework, in order to decide which new areas to explore, but more importantly is a sophisticated set of mathematical tools so that calculations and predictions of experimental results can be made.

It appears to me that the lack of a consistent conceptual framework in current theory is mirrored in the Reciprocal Theory as a lack of an adequate mathematical framework. There are a number of fundamental results from quantum mechanics that are touted by modern physicists as major successes for the theory. These include the hydrogen spectrum, with all of its fine and hyperfine structure, the Stern-Gerlach experiment, scattering theory at high energies, solid state calculations, etc. Unfortunately, few of these
calculations have been done for the Reciprocal Theory. Larson has shown the $1/n^2$ relation for hydrogen but I am unaware of any work to date on the fine and hyperfine structure. Ron Satz produced a solution for Rutherford scattering for alpha particles and gold atoms at one energy level. It has not been shown that this solution can be applied generally to scattering of different particles at different energies.

The point here is not to critique the tremendous amount of work that has been done to date on the Reciprocal Theory, but to indicate that I do not believe that a sufficient body of mathematical relations has been produced, to unequivocally convince myself, or other physicists, that the Reciprocal Theory can be used on a day to day basis to extend our numerical understanding of the universe as well as the theory extends our conceptual understanding.

It may be that the mathematical structure I am asking for already exists in Larson's books. An example might be the kind of geometrical arguments used in filling out the table of interatomic distances. The problem though is that this mathematical structure is not well defined and is used piecemeal throughout the books. Also since it is a geometrical rather than an algebraic structure, it requires the ability to visualize rather than to compute. Many modern theories have begun geometrically, but are used almost exclusively algebraically in practice.

The usual response I get from ISUS members when suggesting something that needs to be done with the theory is "Well, get to work." The reason for writing this letter is not to elicit that same response, but to suggest instead a direction for ISUS that could lead to a wider acceptance of the Reciprocal Theory. It seems odd to me that when many of these basic ideas, such as a complete solution to the hydrogen atom, have not yet been formulated, that ISUS is focusing its energies on solving superconductivity in an yttrium-barium-copper-oxygen compound.

What I am suggesting is that ISUS should take a leadership role in identifying the areas of the Reciprocal Theory where those who are new to the theory find the greatest lacks. These areas should then be published as a priority list for work on the theory. I also feel that most of the individuals working on the theory have followed Dewey Larson's example of the individual working alone. This has resulted in many excellent solutions that are unfortunately disconnected. In order to flesh out the development of the theory, I feel that it is necessary to establish working groups on specific problems. Practically all physics done today is done by such groups, whose size can range from two to hundreds of physicists. The group is responsible for its own internal communications and members of the group will critique each others work until it is decided to publish results.

I realize that ISUS is a small organization, but I feel that working groups are still possible, and that if ISUS is ever to fulfill its fundamental purpose, which is to promote wide acceptance of the Reciprocal Theory, that there needs to be a greater leadership and consensus in ISUS for setting the priorities for research in the Reciprocal Theory.

Sincerely,

Edwin Navarro

Dear Dr. Rigden:

J. Perdijon in September, 1987, AJP asks a reasonable question, "IS LIGHT A PARTICLE?", to which the answer is yes. A particle of light is a particle of vibratory motion, whose energy is proportional to its frequency. This is a true answer to this question, but this answer by itself does not explain the continuous wave character of light. Then, J. Perdijon asks another questions: "If the particle aspect of light is really useful?" This is like asking: What is the use of a new-born baby?

The question: What is light? continues to perplex physicists. For many the difficult wave-particle paradox seems unresolvable and is unresolved. Some think and say that the $5$ billion superconducting super collider (SSC) IS REQUIRED TO DISCOVER "what a photon is". See Sheldon Glashow letter in December 1986 PHYSICS TO-DAY.

Humankind never noticed the persistent wave-particle paradox until the present century. Neither quantum mechanics nor relativity physics has proposed the way to resolve it. In the light of presently available evidence the paradox may be resolved neither by disallowing light to be a wave motion nor by denying that a light photon is a particle of motion. The wave-particle paradox, nevertheless, is resolvable, I think, without SSC or any other machine.

Every light photon, visible and invisible, is a compound motion with two speeds in the light of the physical theory of D. B. Larson. Each photon is a compound of its vibratory motion and a translatory motion. The speed of its vibratory motion is known as its 'frequency' and is intrinsic to the photon. One photon is distinguished from another by its frequency. The vibratory motion is linear, harmonic and transverse to its translatory motion.

The speed of the translatory motion of every photon is known as the 'speed of light' and is extrinsic to the photon. The rectilinear or straight speed of every photon is vacuo is absolutely the same, because the speed of light is extrinsic to the photon. If mass particles move through space, then must massless photons also do so? Not necessarily. What if the physical universe is made so that each massless photon stays in the discrete physical (space-time) location in which it originates, while all physical locations, whether or not occupied by photons progress at the unit speed of $3 \times 10^{10}$ cm/sec? The scalar motion of physical locations has been anticipated by H. Minkowski.

It is the translatory motions of the photon vibratory motion transverse to the translation that confers wave character on the particle of light.

by Frank H. Meyer, Emeritus Member AAPT, Emeritus Member APS

LARSONIAN CONCEPT OF ATOMIC NUMBER
David Halprin and Frank Meyer

Some Mathematical Physical Significance of Atomic Number

The major properties of every element of matter are determined by its atomic number, more so than by its atomic weight or by any other known measure. Mendeleef(1) initially assembled the chemical elements known to him and built the first Periodic Table or Chart of the chemical elements, applying their distinctive atomic weights as the criterion for ordering and arranging them. Moseley(2), examining the characteristic X-ray spectra of series of the chemical elements, discovered an alternative criterion, physically even more satisfactory than atomic weight. Atomic number is this better criterion.

Applying the new criterion, Moseley(3) concluded that there were three unknown elements between aluminum and gold. He also concluded that there were only 92 elements up to and including uranium. In the light of the revalued and unified physics of Dewey B. Larson(4), altogether 117 chemical elements can exist. So far as we know, some of the heavier elements of matter have not yet been discovered on earth or elsewhere. Most of the chemical elements have been discovered and identified already by research workers during the past few centuries. Probably what makes more difficult the discovery of some of the more heavy elements is that they are naturally radioactive.

Each chemical element can be and is associated with its own atomic number, its own unique integer. Thus, a finite set of integers, 1 to 117, is enough to characterize matter in terms of all of its quantized units, the atoms and isotopes of all the elements of matter.

In the beginning, most natural philosophers, including Aristotle, assumed that matter is continuous, infinitely divisible. The discovery about the association of matter with atomic number discloses and confirms that matter is not simply continuous. Matter, instead of being infinitely divisible, is more evidently composed of discrete (finitely divisible) units called atoms, as postulated by Democritus, Leucippus, Epicurus, Lucretius, etc., centuries ago. What the research work of more modern natural philosophers, including Gassendi, Newton, Dalton, Avogadro, Moseley, etc., has accomplished is to establish not the structure but the existence of the atom of matter. In the same way the paper of Einstein(5) on Brownian motion contributed impressive evidence to show beyond a reasonable doubt the existence rather than the structure of material atoms.

In no way has Moseley's discovery of the mathematical physical existence of atomic number and the necessary existence of matter in the form of atoms proven beyond all reasonable doubt the existence of the Rutherford-Bohr nuclear atom model of material atomic structure elsewhere than in the imaginations of many modern natural philosophers. Moseley derived the concept of atomic number entirely from his observations of a proportionality of X-ray frequencies to whole numbers that are equal to the atomic number plus a constant. This is why atomic number will survive the nuclear atom model of atomic structure.

Doubt About And Rejection Of Nuclear Atom Model Of Atomic Structure

Dewey Larson(4) has further investigated the mathematical physical significance of atomic number. His most important result is his discovery...
that the atom of matter is an indivisible whole unit of compound discrete motions. It is not a divisible whole, composed of pre-existing subatomic parts of matter. A living cell may have a nucleus; an atom of matter does not. Nor is the atom a miniature solar system with electrons revolving like planets around a miniature sun. Larson(4) has produced evidence to show that the essential rotational motions constituting each atom of any chemical element can be represented mathematically with a triplet of three small integers for every one of the possible 117 chemical elements of matter.

To begin with, element with atomic number 1: hydrogen is denoted mathematically by 2-1-(1). Element with atomic number 117, not as yet discovered by humankind, is denoted by 5-4-(1).

An integer not enclosed in parentheses denotes net rotational speed displacements in time. An integer enclosed in parentheses denotes linear time displacements rotating with net displacement in space. The latter rotations play an important but limited, subordinate role in the formation of atoms of matter.

Atoms can not and do not form until something to rotate is in existence. This is the photon, a quantum of linear vibrating motion, resulting from the fact that motion is identical with the reciprocal relation of space-time. A photon can acquire rotational motion that must always have direction opposite to that of that of the scalar space-time progression, since any added speed displacement in the positive direction would result in a directional reversal and would produce a vibration rather than a rotation.

For our mathematical purpose it is important to recognize that Larson(4) counts all speed displacement, out of which all physical phenomena arise, from the unit speed of space-time progression. That is, Larson refers all counting to mathematical unity rather than to mathematical zero.

Now rotation differs from translation only in direction and this difference has no meaning from a space-time standpoint, since space-time is scalar. In other words, rotation at unit velocity is indistinguishable from the normal space-time progression; from a physical standpoint it is no rotation at all. In order to produce any physical effect the rotational speed must be a displacement or deviation from unity or unit speed.

The magnitude of the rotational speed of the photon consequently must be greater than that of the space-time progression. Hence when the photon acquires a rotation it travels back along the line of the space-time progression. Since the speed of this retrograde motion is greater than that of the space-time progression, these rotating units are reversing the pattern of free space-time, either in space or time, depending on the direction of the speed displacement.

In the case of immediate interest to us, the rotating units can be and are linear space displacements rotating with net displacement in time. These rotational speed displacements in time produce the well-known and the not so well-known chemical elements of the material sector of the physical universe and their respective atomic numbers.

In the alternative case the rotating units can be and are linear time speed displacements rotating with net speed displacement in space. These combinations do not constitute matter. When you hear vague, ambiguous talk about 'anti-matter,' it is modern physics just becoming acquainted with and not knowing quite what to do about these new entities. From the standpoint of Dewey Larson's Reciprocal System of physics, 'anti-matter' is a
misnomer for the entities forming through net speed displacements in space, since these produced entities are not additive inverses to the chemical elements of matter but rather their multiplicative inverses or reciprocals. Larson prefers to denote the reciprocals of the material elements the 'cosmic elements' and the sector of the physical universe they inhabit the 'cosmic sector', because the principal evidence for their existence is the existence of cosmic radiation.

THE-HALPRIN-ATOMIC-NUMBER-EQUATION-BASED-ON-LARSON'S-TRIPLETS

If we let Z denote atomic number and a,b,c be integers, denoting specified rotational units in each of three orthogonal dimensions, then David Halprin proposes the following atomic number equation for calculating a chemical element's Z in terms of its a,b,c triplet, derived from Larson's Reciprocal System of physical theory:

$$Z + 2 = \frac{(a - 1)(a)(2a - 1) + b(b + 1)(2b + 1)}{3} + c$$

If a = b, this reduces to:

$$Z + 2 = \frac{2b(2b^2 + 1)}{3} + c$$

If a = b + 1, then it becomes:

$$Z + 2 = \frac{2b(b + 1)(2b + 1)}{3} + c$$

TABLE I. RANGE OF Z BASED ON LARSON'S TRIPLETS (a, b, c)

<table>
<thead>
<tr>
<th>a = b</th>
<th>a = b + 1</th>
<th>Range of c</th>
<th>Z</th>
<th>Range of Z</th>
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<tbody>
<tr>
<td>a</td>
<td>b</td>
<td></td>
<td>Z</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>-1 to 4</td>
<td>c + 2</td>
<td>1 to 6</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>-4 to 9</td>
<td>c + 10</td>
<td>6 to 14</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>-15 to 16</td>
<td>c + 54</td>
<td>46 to 70</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>-15 to -1</td>
<td>c + 118</td>
<td>103 to 117</td>
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TABLE II. COMPUTATION OF ATOMIC NUMBER OF 117 CHEMICAL ELEMENTS OF MATTER

<table>
<thead>
<tr>
<th>Chemical Element</th>
<th>Larson Triplet</th>
<th>Atomic Number</th>
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<tbody>
<tr>
<td>HYDROGEN</td>
<td>2 1 (1)</td>
<td>1</td>
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<td>HELIUM</td>
<td>2 1 0</td>
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<td>LITHIUM</td>
<td>2 1 1</td>
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<tr>
<td>BERYLLIUM</td>
<td>2 1 2</td>
<td>4</td>
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<tr>
<td>BORON</td>
<td>2 1 3</td>
<td>5</td>
</tr>
<tr>
<td>CARBON</td>
<td>2 1 4</td>
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<td>NITROGEN</td>
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<td>OXYGEN</td>
<td>2 2 2 (3)</td>
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<td>2 2 2 (1)</td>
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<td>NEON</td>
<td>2 2 0</td>
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<td>MAGNESIUM</td>
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<td>ALUMINUM</td>
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<tr>
<td>SILICON</td>
<td>3 2 4</td>
<td>14 C 16.2-7</td>
</tr>
<tr>
<td>Chemical Element</td>
<td>Larson Triplet</td>
<td>Atomic Number</td>
</tr>
<tr>
<td>-------------------</td>
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<td>---------------</td>
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A way alternative to the Halprin equations to compute and check the atomic number of an element, say, mendeleium, is to read Larson(4) and use its triplet: 4-4-15 and his physics of the atom of matter as follows: 

\[ Z = 2(1)^2 + 2(2)^2 + 2(3)^2 + 2(1)^2 + 2(2)^2 + 2(3)^2 + 2(4)^2 + 15 - 2 = 101. \]

Similarly, the atomic number of hydrogen, based on its triplet: 2-1-(-1), is \[ Z = 2(1)^2 + 2(1)^2 + (-1) - 2 = 1. \]
References

1. Mendeleev, D. PRINCIPLES OF CHEMISTRY, Moscow, 1868.

NEW BOOK ANNOUNCEMENT

Dewey B. Larson's latest book BASIC PROPERTIES OF MATTER is now available. It covers basic topics in heat and temperature effects and electrical and magnetic effects. It is Volume II of the updated and expanded THE STRUCTURE OF THE PHYSICAL UNIVERSE (1959). It along with NOTHING BUT MOTION (Vol I) and THE UNIVERSE OF MOTION (Vol III) completes the updating of THE STRUCTURE OF THE PHYSICAL UNIVERSE.

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THE GRAVITATIONAL LIMIT AND THE HUBBLE'S LAW

K.V.K. NEHRU

1. The Gravitational Limit

Gravitation and Space-time Progression (STP) are the two oppositely directed scalar motions that decide the outcome of all physical phenomena in the universe of motion. There are two hitherto unknown features of gravitation that the Reciprocal System has brought to light. The first one, which is relevant to atomic-scale phenomena, is that in the context of the familiar three-dimensional stationary frame of reference, the direction of gravitation reverses at the unit space limit: it manifests as a repulsive force in the time region--the region inside unit space. This phenomenon forms the basis of cohesion in solids.

The second feature is relevant to large-scale phenomena and is concerned with gravitation of mass aggregates. Even though the net total gravitational motion of a material aggregate is constant, the effective magnitude of its force aspect is attenuated by the inverse-square law in the context of the three-dimensional stationary frame of reference. On the other hand, the magnitude of the force aspect of the STP is independent of distances since the progression originates at every location of the reference frame. Consequently, Larson points out, "...the gravitational limit of a mass is the distance at which the inward gravitational motion of another mass toward the mass under consideration is equal to its outward motion due to the progression of the natural reference system relative to our stationary system of reference..." [1]. Thus the net motion inside the gravitational limit is inward while outside it is outward.

Let us consider a spherical aggregate of mass M. The force due to its gravitational motion acting on a unit mass situated at a distance \( x \) (outside of it) is given by

\[
ag = - \frac{G M}{x^2} \quad \text{dynes/gm or cm/s}^2 \quad (1)
\]

where \( G \) is the 'universal' constant of gravitation. The minus sign implies that the force is directed inward (that is, tending to decrease intervening distance).

In a similar manner, we can write that the outward force on the unit mass due to progression as

\[
ap = P \quad \text{dynes/gm or cm/s}^2 \quad (2)
\]

where \( P \) may be referred to as the universal constant of progression. Thus the net force per unit mass (that is, acceleration) at a distance \( x \) from a mass \( M \) is given by

\[
an = ap + ag = P - \frac{G M}{x^2} \quad (3)
\]

Larson [1] evaluates the gravitational limit adopting the magnitudes of the quantities concerned in natural units. In the natural

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units the so-called 'constants of nature' do not occur, these being the result of arbitrary choice of the conventional units. Thus the gravitational force, in natural units, due to a mass M at a distance x (both in natural units) is simply $M/x^2$. And since the force due to progression, again in natural units, is unity, the gravitational limit $d_0$ is evaluated from the relation

$$\frac{M}{d_0^2} = 1$$  \hspace{1cm} (4)

However, there is another factor to be considered. Gravitation is the translatory aspect of the scalar rotation that constitutes units of matter (atoms). The rotation exists within unit space (the time region), whereas the linear translatory effect manifests in the three-dimensional space (the time-space region). We have shown elsewhere [2] that the atomic rotation is distributed over 156.44 degrees of freedom in the time region. In addition, linear translatory motion in the three-dimensional spatial region is distributed over 8 degrees of freedom. As such the number of rotational units (mass units) in the time region that are in equilibrium with a unit of linear translation in the time-space region is $156.44 \times 8$. But it will be recalled that gravitation is a three-dimensional motion: in fact, a three dimensional inverse speed [3]. In terms of space time units its natural dimensions are $t^3/s^3$. Hence the total number of possibilities over which the gravitation effect of a unit of mass is distributed is $(156.44 \times 8)^3$. Considering this, eq (4) above has to be rewritten as

$$\frac{M}{(156.44 \times 8)^3} = d_0^2$$

in natural units.

Adopting the values of $1.65979 \times 10^{-24}$ g and $4.558816 \times 10^{-6}$ cm for the natural units of mass and length respectively from Larson [4], we have the gravitational limit of a mass aggregate M as

$$d_0 = 3.77 \frac{M}{M_0}^{1/2} \text{ lightyears}$$  \hspace{1cm} (5)

where $M_0$ is the mass of the sun.

Using eq (3) and setting $a_n = 0$ at the gravitational limit, we can now evaluate the force due to STP as applicable to aggregate phenomena (and in the context of a three-dimensional stationary reference frame) as

$$P = G \frac{M}{d_0^2}$$  \hspace{1cm} (6)

$$= 1.044 \times 10^{-11} \text{ dyne/gm}$$  \hspace{1cm} (6-a)

2. Speeds in the region inside the gravitational limit

We can obtain the expressions for the speeds due to gravitation and progression respectively from eqs (1) & (2). If $v_g$ is the gravitational speed and t the time, from eq (1),

$$a_g = \frac{dv_g}{dt} = \left(\frac{dv_g}{dx}\right) \times v_g = - \frac{G M}{x^2}$$
On integrating we get
\[ v_g^2 = 2 \frac{GM}{x} + b_1 \]  
(7)

where \( b_1 \) is the constant of integration. Similarly, taking \( v_p \) as the speed due to progression, from eq (2) we have
\[ a_p = (dv_p/dx) * v_p = P \]

On integrating we have
\[ v_p^2 = 2P \ x + b_2 \]
(8)

with \( b_2 \) as the constant of integration. Taking, at the gravitational limits \((x=d_0)\), the net speed \( v_n \) (= \( v_p - v_g \)) to be zero we have \( v_p = v_g \). Hence we obtain from eqs (7) & (8)
\[ b_1 - b_2 = 2(P \ d_0 - GM/d_0) = 2 \ d_0(P - GM/d_0^2) \]

Substituting from eq (6) we finally have \( b_1 = b_2 \). Since \( b_1 \) and \( b_2 \) pertain to two motions of altogether different origins one possibility that immediately suggests itself is that \( b_1 = b_2 = 0 \). In fact, empirical evidence (on the velocity of escape) validates this possibility. We can now write down the expression for the gravitational speed from eq (7). We will find it convenient to have the equations in non-dimensional form. Therefore we write
\[ v_g = (2 \frac{GM}{x})^{1/2} = (2 \frac{GM}{d_0})^{1/2} * (d_0/x)^{1/2} = v_0/y^{1/2} \]
(9)

where \( y = x/d_0 \), the distance in non-dimensional form and
\[ v_0 = (2 \frac{GM}{d_0})^{1/2} \]
(9-a)

which we shall henceforth refer to as the "zero-point speed" of the mass aggregate. The zero-point speed \( v_0 \), may be viewed as the gravitational speed that is in equilibrium with the STP at the equilibrium distance \( d_0 \). It has the significance of being the natural unit of speed germane to a mass aggregate. It serves the same function in the case of mass aggregates as is served by \( c \), the speed of light in the case of individual mass units.

Using eqs (8) & (6) we can write the speed due to progression as
\[ v_p = v_0 * y^{1/2} \]
(10)

Finally, the net speed in the region inside the gravitational limit (\( y \leq 1 \)), but outside the mass \( M \) is given by
\[ v_n = v_p - v_g = v_0(y^{1/2} - 1/y^{1/2}) \]
(11)

It may be noted that for distances considerably smaller than the gravitational limit, this equation reduces to
\[ v_n = - v_0/y^{1/2} \]
(11-a)
(the minus sign implying that the speed is inward.)

3. Speeds in the region outside the gravitational limit

An examination of equation (11) shows that while the net speed is negative (radially inward) within the gravitational limit, it is positive or outward in the region beyond it. The crucial point that must be recognized at this juncture is that "...the tree-dimensional region of space extends only to the gravitational limit...beyond this limit...the gravitational effect of the aggregate...is in equivalent space rather than in actual space."[5]. Larson further points out that all quantities in equivalent space are two dimensional in terms of actual space [6]. Therefore, in order to obtain the speeds pertaining to the region beyond the gravitational limit we have to take the respective second power expressions.

First we convert the gravitational speed \( v_g \) into the natural units by dividing by the zero-point speed \( v_0 \) of the aggregate and then square it. Thus, the expression for the gravitational speed in the outer region is \((v_g/v_0)^2\). However, as this is two-dimensional, the effective speed in the dimension of the time-space region is half of this quantity. Therefore, the gravitational speed for \( x > d_0 \) is given by

\[
v_{g0} = \frac{1}{2} (v_g/v_0)^2 \quad \text{in natural units} \\
= \frac{1}{2} (v_g/v_0)^2 \times v_0 \quad \text{in cm/s}
\]

Substituting for \( v_g/v_0 \) from eq (9)

\[
v_{g0} = \frac{1}{2} v_0/y \quad (12)
\]

Following similar procedure, we obtain from eq (10) the speed due to STP effective in the outer region as

\[
v_{p0} = \frac{1}{2} v_0 \times y \quad (13)
\]

Finally, the net speed in the outer region is

\[
v_{n0} = \frac{1}{2} v_0(y - 1/y) \quad (14)
\]

4. The Hubble's law

It can readily be seen that for distances large compared to the gravitational limit eq (14) reduces to

\[
v_{n0} = \frac{1}{2} v_0 \times y \quad (14-a)
\]

where \( v_{n0} \) is an outward speed. Substituting for \( v_0 \) and \( y \) in terms of the original variables

\[
v_{n0} = \frac{1}{2} (2 GM/d_0)^{1/2}(x/d_0) = (GM/2 d_0^3)^{1/2} \times x \quad (15)
\]
This is identical to the Hubble's law of the recession of the distant galaxies:

\[ v_r = H \cdot x \]

The Hubble's constant turns out to be

\[ H = (\frac{GM}{2d_0^3})^{1/2} \]  (16)

Substituting for \( d_0 \) from eq (5) we note that the Hubble's constant is inversely proportional to the fourth root of the galactic mass. Thus if \( M \) is in solar mass units,

\[ H = \frac{37302.19}{M^{1/4}} \quad \text{km s}^{-1} \text{ Mpc}^{-1} \]  (16-a)

The value of the Hubble's constant could be calculated from the above equation if we know the mass of our galaxy accurately. As it turns out, it is the Hubble's constant that we know with less uncertainty than the mass of the galaxy. We will, therefore, calculate the mass of the galaxy from the above equation. Adopting the value \( H = 55 \text{ km s}^{-1} \text{ Mpc}^{-1} \), we have the following results for our galaxy

\[ M_G = 2.116 \times 10^{11} \quad \text{solar mass units} \]

\[ d_{0G} = 0.532 \quad \text{Mpc} \]

and \[ v_{0G} = 58.5 \quad \text{km s}^{-1} \].

In passing it may be remarked that eq (14-a), which leads to the strictly linear form of the Hubble's law, is not applicable to shorter distances comparable to \( d_0 \). For these distances eq (14) must be used. The discrepancy between the results of the two equations becomes significant for distances less than about 10 times \( d_0 \) (that is, about 5 Mpc in the case of our galaxy). However, whether the variation of the recession speed within this distance range follows the strictly linear law is not observationally verifiable. This is because the speeds of the peculiar motion of these nearby galaxies are commensurate with their recession speeds and since the former are random in nature no conclusion is possible regarding the manner of variation of the recession speed of these nearby galaxies with the distance.

5. Summary

(i) The gravitational limit of an aggregate of mass \( M \) is given by

\[ d_0 = 3.77 \ (M/M_0)^{1/2} \quad \text{lightyears} \]

where \( M_0 \) is the mass of the sun.

(ii) The value of the universal constant of progression for aggregate phenomena is

\[ P = 1.044 \times 10^{-11} \quad \text{cm/s}^2 \]
(iii) The natural unit of speed for a mass aggregate, called the zero-point speed, is given by
\[ v_0 = (2 \frac{GM}{d_0})^{1/2} \text{ cm/s} \]
where \( G \) is the universal constant of gravitation.

(iv) The net speed due to gravitation and progression outside of a mass aggregate of mass \( M \), at a distance \( x \) is given by
\[ \begin{align*}
v_n &= v_0(y^{1/2} - 1/y^{1/2}) \quad \text{for } y \leq 1.0 \\
v_{n0} &= (1/2)v_0 (y - 1/y) \quad \text{for } y \geq 1.0
\end{align*} \]
where \( y = x/d_0 \).

(v) The recession speed of distant galaxies (\( x > 10 \ d_0 \)) is given by
\[ v_r = H \times x \]
where
\[ H = \frac{GM}{2d_0^3}^{1/2} = 37302.19/(M/M_0)^{1/4} \text{ km s}^{-1} \text{ Mpc}^{-1} \]
\( M \) being the mass of our galaxy.

(vi) The results calculated for our galaxy on the basis of
\[ H = 55 \text{ km s}^{-1} \text{ Mpc}^{-1} \]
are mass = \( 2.116 \times 10^{11} \) solar units
gravitational limit = \( 0.532 \) Mpc and
zero-point speed = \( 58.5 \) km s\(^{-1}\)

************** References **************
4. ibid., p. 160
6. ibid., p. 210
GLOBULAR CLUSTER MECHANICS
IN THE
RECIPROCAL SYSTEM

by
Ronald W. Satz

This paper discusses the forces on stars in a globular cluster. Consider Figure 1; the symbols are defined as follows:

\[ M_g \] = mass of the stars of a globular cluster internal to that of a particular star
\[ m \] = mass of that particular star
\[ m_p \] = mass of the nearest neighboring stars
\[ x_g \] = distance of the star from the mass center of the globular cluster
\[ x_p \] = distance of the star from the mass center of the nearest neighboring stars
\[ x_{pg} \] = distance of the mass center of the nearest neighboring stars from the mass center of the globular cluster
\[ x_{po} \] = equilibrium distance of the star from the mass center of the nearest neighboring stars
\[ x \] = distance of the star from the mass center of the nearest neighboring stars, relative to the equilibrium distance

Recall that in the Reciprocal System two forces are acting on the star:

1. Gravitation of the star by the cluster as a whole—this produces an inward motion.
2. Progression of the star away from its nearest neighbors—this produces an outward motion.

My goal in this paper is to derive the expression for the net force acting on the star, to find the equilibrium position \( x_{po} \) of the star, and to determine whether or not this position is stable.

Nohr's recent paper [1] provides the starting point. Some additional symbols are needed:

\[ d_{og} \] = gravitational limit of the globular cluster
\[ d_{op} \] = gravitational limit of nearest neighboring stars
\[ y_g \] = non-dimensional distance of the star from the mass center of the globular cluster
\[ y_p \] = non-dimensional distance of the star from the mass center of the nearest neighboring stars
\[ v_{og} \] = "zero-point speed" of the star relative to the globular cluster
\[ v_{op} \] = "zero-point speed" of the star relative to the nearest neighboring stars

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\[ v_{ng} = \text{net inward gravitational speed of the star} \]
\[ v_{np} = \text{net outward progression speed of the star} \]
\[ v_n = \text{net speed of the star} \]
\[ G = \text{universal gravitational constant} \]
\[ M_0 = \text{mass of the sun} \]
\[ a = \text{acceleration from gravitation of the globular cluster} \]
\[ a_p = \text{acceleration from progression away from the nearest neighbors} \]
\[ a_n = \text{net acceleration of the star} \]

In this notation,

\[ d_{og} = 3.77^*(M_g/M_0)^{1/2} \text{ (ly)} \]  
\[ (1) \]
\[ \gamma_g = x_g/d_{og} = (x + x_{po} + x_{pg}) / d_{og} \]  
\[ (2) \]
\[ v_{og} = (2G*M_g/d_{og})^{1/2} \]  
\[ (3) \]
\[ v_{ng} = v_{og} \left(1/\gamma_g^{1/2} - \gamma_g^{1/2}\right) \text{ (inward)} \]  
\[ (4) \]
\[ d_{op} = 3.77^*(m_p/M_0)^{1/2} \text{ (ly)} \]  
\[ (5) \]
\[ \gamma_p = x_p/d_{op} = (x + x_{po}) / d_{op} \]  
\[ (6) \]
\[ v_{op} = (2G*m_p/d_{op})^{1/2} \]  
\[ (7) \]
\[ v_{np} = (1/2)^*v_{op} \left(\gamma_p - 1/\gamma_p\right) \text{ (outward)} \]  
\[ (8) \]
\[ v_n = v_{np} - v_{ng} \]  
\[ (9) \]

Differentiating the velocity expressions with respect to time gives the accelerations:

\[ a_g = G*M_g \left(1/x_g^2 - 1/d_{og}^2\right) \text{ (inward)} \]  
\[ (10) \]
\[ a_p = G*m_p \left(1/2\right)^*(x_p/d_{op}^3 - d_{op}/x_p^3) \text{ (outward)} \]  
\[ (11) \]
\[ a_n = a_p - a_g \]  
\[ (12) \]

At equilibrium,

\[ a_n = 0 \]  
\[ (13) \]

Let

\[ h = m_p/(2*d_{op}^3) \]  
\[ (14) \]
\[ l = M_g^*\left(1/d_{og}^2 - 1/x_g^2\right) \]  
\[ (15) \]
\[ j = (1/2)^*m_p^*d_{op} \]  
\[ (16) \]
Then, in terms of \( x_{p0} \), at equilibrium,
\[
h^4 x_{p0}^4 + l^3 x_{p0}^3 - j = 0
\]  
(17)
a quartic equation.

The appendix gives a simple computer program written in \textsc{BASIC} to solve equation 17 numerically. (An attempt to solve the equation analytically using the \textsc{Mumath} \textsc{AI} program failed). A sample run with \( M = 200 M_\odot \), \( m = 2 M_\odot \), \( x = 40 \) ly, \( d_{p0} = 53.32 \) ly, and \( d_{p0} = 5.33 \) ly produced \( x_{p0} = 9.29 \) ly. Another sample run with \( M = 500000 M_\odot \), \( m = 200 M_\odot \), \( x = 400 \) ly, \( d_{p0} = 652.98 \) ly, and \( d_{p0} = 53.32 \) ly produced \( x_{p0} = 178.94 \) ly. Input parameters that physically impossible produce negative distances.

Now let's turn to the question of the stability of this position, \( x \). The net force acting on the star in terms of the distance from equilibrium, \( x \), is

\[
F = m^*G^*((1/2)^*m_p^*((x_{p0} + x)/d_{op}^3 - d_{op}/(x_{p0} + x)^3) - M_g^*(1/(x_{p0} + x + x_{pg})^2 - 1/d_{og}^2))
\]  
(18)

Differentiating \( F \) with respect to \( x \) gives

\[
dF/dx = m^*G^*((1/2)^*m_p^*(1/d_{op}^3 + 3d_{op}/(x_{p0} + x)^4) + 2M_g/(x_{p0} + x + x_{pg})^3)
\]  
(19)

If \( x \) is positive, \( dF/dx \) is positive and hence \( F \) increases with \( x \). If \( x \) is negative, \( dF/dx \) is still positive. Thus

\[ - dF/dx < 0 \]  
(20)

This is the definition of instability. Hence, \( x \) is a point of unstable equilibrium. But there is one saving grace: the forces near this point are quite small, so sudden changes in position are precluded.

Globular clusters continually grow by accretion until eventually being absorbed into galaxies. The stars in the clusters must keep changing their temporary equilibrium positions.

Reference

CLS
PRINT "PROGRAM TO SOLVE GLOBULAR CLUSTER MECHANICS by Ronald W. Satz"
PRINT: PRINT
INPUT "Enter internal mass of globular cluster in solar units: ", MG
INPUT "Enter mass of neighboring stars in solar units: ", MP
INPUT "Enter distance in light years, of star from cluster center: ", XG
DOP=3.77*SQRT(MP): DOG=3.77*SQRT(MG) 'gravitational limits
H=.5*MP/DOP^3: I=MG*((1/DOG^2) - 1/XG^2): J=.5*MP*DOP
D=I/H: E=J/H
XPO = E^(.25) 'starting point for the iterations
PRINT
'Now use method of successive substitution
FOR L = 1 TO 80 'The higher the number, the greater the accuracy.
XPO = (E - D*XPO^3)^(.25)
NEXT L
PRINT "The gravitational limit, DOG, of cluster is: "; DOG; " light yea
PRINT "The gravitational limit, DOP, of neighbors is: "; DOP; " light yea
PRINT "The equilibrium separation distance, XPO, is: "; XPO; " light yea
PRINT "LHS = "; .5*MP*(XPO/DOP^3 - DOP/XP^3)
PRINT "RHS = "; MG*((1/XG^2) - 1/DOG^2)
PRINT "Distance of MP from cluster, XPG, is: "; XG-XPO; " light yea
XPG = XG - XP: PRINT
INPUT "Enter distance from equilibrium, X: ", X
F1 = .5*MP*((XPO+X)/(DOP^3) - DOP/(XPO+X)^3)
F2 = MG*((1/(XPO+X+XPG)^2) - 1/DOG^2)
F = F1 - F2
PRINT "The force, F/mG, at this distance is: "; F
PRINT: GOTO 20 'Press <BREAK> to quit.
'Note: Because of the numerical method used, the force at XPO is not quite zero.

PROGRAM TO SOLVE GLOBULAR CLUSTER MECHANICS by Ronald W. Satz

Enter internal mass of globular cluster in solar units: 30000
Enter mass of neighboring stars in solar units: 200
Enter distance in light years, of star from cluster center: 400

The gravitational limit, DOG, of cluster is: 652,9831 light years.
The gravitational limit, DOP, of neighbors is: 53,31585 light years.
The equilibrium separation distance, XPO, is: 178,9431 light years.
Distance of MP from cluster, XPG, is: 221,0569 light years.

Enter distance from equilibrium, X: 2
The force, F/mG, at this distance is: 9,995979E-02

Enter internal mass of globular cluster in solar units:
SPACE-TIME AND MOTION: THEIR CONNECTION/EQUIVALENCE

Frank H. Meyer and David Halprin

Dewey B. Larson (1.2) has discovered and elaborated how to unify Physics through the 'Reciprocal System of Physics and Philosophy'. This discovery is the one most important development and achievement of world science since the Copernican Revolution, which began in sixteenth century Poland and Europe. Larson has accomplished his work, it could be said, by following the precept of Nietzsche: "If you seek comfort, then believe; if you seek Truth, inquire."

Before Copernicus religion and science in the West taught that the supreme worth of Humankind depended on the presumed fact that the Physical Universe is centered upon the immovable Earth. The presumed fact was, and is, no fact at all. Copernicus' detection of this elementary error of science and religion was a most beneficial development. "A truth that disheartens because it is true, is of far more value than the most stimulating falsehood." Without veracity neither Science nor Religion can be produced, let alone unified. Just as there was much to be grateful for, that came from the Greek philosophers, the Renaissance and the foundations of Christianity, we humans were too eager to adopt these precedents of behavior and thought, to the extent that we never questioned in depth the less favorable, yet concomitant aspects, that accompanied these stepping stones in our development. These unhelpful aspects included rigidity of thought and unquestioning features of belief and precedent. This led us into a too narrow approach to many problems, that were best solved by stepping back and examining all aspects, both intrinsic and extrinsic, and also explicit and implicit. The implicit assumptions are the most insidious, because they can be so difficult to detect. Such assumptions mostly are not even suspected and also our lines of thinking, as taught by example and rote, seldom suggest making the effort in any discipline to seek alternatives. If we look for alternatives, even if we eventually reject them, then we can at least conclude that we have analyzed our problem in every whichway we can think of and have come up with the best solution we can.

More than four centuries after Copernicus, as the twentieth century draws to a close, Science is about to take a giant leap forward toward unification. Thanks to the Reciprocal System, a quiet revolution recently already has occurred in Physics. This break in continuity will take the Copernican Revolution further forward, turning Science from a rigidly-formed sun-centered bias to a creative-thinking-in-depth-human-centered synthesis. It will accelerate the world-wide endeavor genuinely to unify Physical Science in a fudge-free theoretical environment that commenced at the beginning of this century, albeit with some implicit assumptions, now shown by Larson to be false.

REVALUED AND UNIFIED PHYSICS

The basic premises of Larsonian physics consist of certain preliminary assumptions, a postulate and a definition.
In order to make science possible, some preliminary assumptions must be make. We assume that the universe is rational, that the same physical laws apply throughout the universe, that the results of experiment are reproducible, etc. These assumptions are accepted by scientists as a condition of becoming scientists, and are not usually mentioned in purely scientific discourse.

We assume that the generally accepted principles of mathematics, to the extent that they will be used in this development, are valid.

We postulate that the universe is entirely composed of one component, motion, existing in three dimensions and in discrete units.

We define motion as the relation between two uniformly progressing reciprocal quantities, space and time.

Summarily, any worthwhile endeavor to describe the Physical Universe can be analyzed into three major related essential parts:

1. **The Postulational Base**, which we know to be called variously as axioms, codes, hypotheses, laws, postulates, premises, assumptions, definitions, etc. and these are expressed in a language of choice, which has two aspects, linguistic and mathematical.

2. **The Syntactic**, which develops this language by logical deduction, into the assertions and theorems of the Paradigm.

3. **The Semantic**, which relates this inductive theory to our observations. This should, then, give the theory the ability to predict other observations, confirming the theory, provided the theory does predict, as expected. If one prediction is false, then the theory and/or model is false.

Unfortunately, this analysis, although accurately describing the status quo, reveals a shortcoming: The syntactic, as defined, is not all-comprising, and hence can miss certain 'findings', which when found, can, with hindsight, be shown intuitible with aforesaid logic, but rarely are so found. This perhaps happens because the paths to their discovery are overgrown with obfuscating implicit assumptions, bringing about an unrecognized blinders-vision. Nevertheless, it also is via such alternate pathways that some of the greatest discoveries have been made. They probably may be best described as inspiration or creative thinking. It is on account of such an example, the Reciprocal System of Physical Theory, that we have chosen to write this paper.

**OVERCOMING DISUNITY IN PHYSICS**

Physics presently is disunited, more by what physicists know that is NOT so, than by what we don't know. No scientific theory should have within the same paradigm two parts that need uniting. This represents a foundation for error, to put it nicely, and 'fudging', to use the modern but tactless parlance. Similarly, another gross error is today widespread in science: the belief that all that exists in the Human Universe is Space and Time, is in Space and Time, and specifically in an
unmoving, four-dimensional space-time continuum. This is rife with implicit assumptions. This contemporary situation in Physics is analogous to that which prevailed in sixteenth and seventeenth centuries Europe. The general run of natural philosopher then knew that Heaven, Earth and the rest of the Physical Universe centered about an immobile planet. At that time philosophers were referred to as 'Natural Philosophers'. Today's philosophers of Nature 'know' that all which exists on Earth, in Heaven and beyond is centered about moving matter. However, the Physical Universe is no more centered about moving matter than all of existence is, or ever was, centered about an immovable Earth.

D. B. Larson has shown that the Physical Universe is the whole finite Universe of Motion with speed displacements from the 'unit speed' of Space-Time Progression.

Contrary to what A. Einstein, many relativity physicists, quantum mechanists and dialectical materialists have affirmed it to be, the Physical Universe is NOT essentially a universe of matter. Consequently, Time, Space, Motion, Energy, etc. are NOT simply mere properties and/or forms of the existence of matter.

The physics of D. B. Larson discloses that the nature of the Physical Universe is such that there can only be two mutually exclusive types of observers: 1) observers of phenomena of the material sector, the sector of motion in space and 2) observers of phenomena of the inverse material or 'cosmic' sector, the sector of motion in time. Cosmic entities move in time with speeds in excess of unit speed, in excess of the speed of light. From the reciprocal relation between space and time that D. B. Larson postulates it follows that all the relations found in the material sector are also valid in the inverse form: that is, with space and time interchanged in the inverse material (so-called, misnamed 'anti-matter' sector). Cosmic entities are not observable in our material sector for two reasons: 1) the atoms that constitute cosmic physical objects are contiguous in time, not in space, and consequently they are not objects for us, and 2) we can only observe phenomena that exist in our location in time. Objects moving at speeds greater than that of light do not. Material entities are not observable from the cosmic sector for the same kind of reasons with time and space interchanged.

These facts account for why all previous physical theories have fallen short of the best intentions of their proponents. Rigidity has been a very limiting constraint. An observer can only witness manifestations that are specific to his class of observer. How the Physical Universe manifests itself is exactly in accordance with the observer's relationship with the Universe. Notwithstanding the foregoing, within each class of observer, the possible observations depend on his relationship with the existents within his compass, taking into account relative speeds or absence thereof, local gravitational effects and localized effects of the outward expansion of the Physical Universe. In other words, one can say that the manifestations of motion split the existents into the two categories, only one of which is observable to a given observer. The other category tends to fall into the thought default of preceding thinkers. While this appears to imply
two sectors of the Physical Universe, it merely implies, in fact, two classes of observers.

A model of the Physical Universe premised on moving matter and energy, contradicts itself. Because motion is presumed to be only a property of matter and energy, this model implies that motion without something moving is impossible. Of course, this rules out any possible uniform progression of time with space at the speed of one discrete unit of space per one discrete time unit. Here is the reason that conventional classical and modern physicists have been unable to measure the rate of clock time progression. Some relativity physicists even argue that time does not progress, does not pass by itself with space, but waits for the man and the tides to make the first move. Space-Time progression is an immaterial physical phenomenon, a nothing (no-thing) physical phenomenon, due to the finite divisibility of Space-Time. What has to be recognized also is that, if matter were the exclusive source of motion, (that is, if motion were the exclusive property of matter), then matter would be SELF-moving. In consequence, perpetual motion of both the first kind and of the second kind not only could NOT be prohibited, but can and does occur. However, no one has yet conclusively demonstrated the actual existence of perpetual motion in the Physical Universe. Until someone does demonstrate it, the hoary hypothesis that motion is nothing but an unessential or essential property of matter had better be discarded in favor of the postulate that motion is identical with Space-Time.

IDENTITY OF SPACE-TIME

An outstanding discovery of the Reciprocal System of Physics is that the Physical Universe, as the universe of motion, is limited to the world of space and time and/or that physical Space-Time is IDENTICAL with Physical Motion. This is because physical motion always involves a special relation of space and time and NOTHING ELSE. We define motion as the relation between two uniformly progressing reciprocal quantities, space and time.

Without identifying the nature of Space and Time, Newton found them to be quite unrelated. Without identifying the nature of the relation of Space and Time, Einstein did find them to be related and assumed them to be inseparable in physical fact. Unfortunately, both Einstein and Newton ruled out the possibility that Space and/or Time have to do with and are related to motion. Both agreed with Isaac Barrow's reply to the question: "But does not time imply motion?" "Not at all." Both disagreed with Aristotle, for whom "time is an aspect of motion." Neither Aristotle, nor Newton nor Einstein recognized that Space also is an aspect of motion.

In actuality, Time and Space are the two necessary and sufficient conditions (or aspects) of ALL physical phenomena of motion. All physical motion, according to Larson (1,2,3) is invariably a reciprocal (or multiplicative inverse relation) of time to space. In their turn, Space and Time together depend for their very existence on the existence of Motion. Anyone who compares slow motion with faster motion can easily verify that the slower motion implies less space in a given time
than does the faster motion. This is equivalent to saying that the faster motion traverses more space in the same time or the same space in less time. This is because we use the ratio $v = s/t$, from which we see that an increase in space is the equivalent of a decrease in time.

The reciprocal relational motional character between space and time is not a trivial as it may appear superficially. The implications are far-reaching. It is not trivial that the speed of light in vacuo, the speed of the expansion of the universe and the unit speed of the three-dimensional scalar uniform outward space-time progression are one and the same magnitude. Light is a compound motion of translation and one-dimensional vibration. The speed of light is not the rate of translation of a photon through space but rather the translational speed of the space-time (physical) location in which the photon vibrational motion originates. The expanding universe is not the motion of the galaxies through space, but is the uniform scalar expansion of space. The expansion can be described as the scalar motion of physical locations, represented as outward in the spatial reference systems. Both the speed of light and the 'expansion of the universe' are related aspects of the finite rate of space-time progression at unit speed, the uniform speed of the discrete units of motion of which the physical universe is entirely composed.

Since matter and energy were finally recognized at the beginning of this century by the quantum physicists, including Einstein and Planck, as composed of and by discrete units of motion, it really does not require such a stretch of scientific imagination to recognize by the end of this century that space-time too is quantized rather than a simple 4-dimensional stationary continuum, such as was postulated in the Einsteinian theory of relativity. The difference between quantized and continuous is the difference between finitely divisible and infinitely divisible.

Such a consideration, done discreetly at first and tested thoroughly for all its implications, forced Larson to the inescapable conclusion that Space and Time were discrete. In so doing, he then had hindsight, as we all do now, that obviously we should have had Space-Time and Motion quantization as a part of the Postulational Base from the beginning. After all, if current thinking methods were sufficient when we were in the Syntactic phase, starting from the original Postulational Base we would have proceeded with our 'infallible mathematical logic' to uncover any contradictions and/or facts that were remiss. Until Larson, this did not occur, and of course, our complacency and concomitant love of sitting on our laurels, together with wide acceptance of dogmatism accounts for the slowing down of our approach to our goal of revaluing and unifying physics. Out best criterion for validity is the very logic, given us by the ancient Greeks, which is used for the double purpose of reaching our conclusions and thereupon defending them. So we implicitly equate Logic with Truth and this hubristic attitude tends to lead more often 'up the garden path' than along 'the road to truth'.

So to recapitulate, the Syntactic phase is where 'the truth will out', if and only if, we stand back and examine our data, both in detail
and in overview, and look for as many alternate paths that we can imagine, no matter how absurd they may appear at first. For we can always reject each and/or every one of them at any time. However, one of these paths may be paved with the seeds of golden memes, waiting to be wetted with the imagination, upon which they will germinate and eventually release their essences into the ideosphere for dissemination into the minds of serious inquirers of today.

Recognizing the identity of Motion and Space-Time, D. B. Larson has created the Reciprocal System of Physics. The name given to this system of physical theory and practice is aptly derived from the theory's definition of motion as the relation between two uniformly progressing reciprocal quantities, Space and Time.

Through the aid of the Reciprocal System Larson has discovered an important and useful fact for the revaluation and unification of physics: The Physical Universe is entirely finite and can be adequately counted and calculated with finite arithmetic and mathematics. The Physical Universe, while enormous, is a finite whole; it is finite in all, each and everyone of its parts and is finite, cyclical, unevolving and unchanging as a whole. The Physical Universe is in no sense infinite. To quote Larson (4):

"Infinity is excluded from it, since we are defining motion as a relation between a time magnitude and a space magnitude, and we deduce that the quantity of motion is finite. Since all physical entities and phenomena are manifestations of motion, they are all measured in terms of 1/n or n/1, where n is finite. No infinities are possible. This is another of the many places, where the Reciprocal System of Physics has an advantage over conventional theory, in which infinities are a considerable source of embarrassment. As Richard Feynman puts it: 'If we get infinity, how can we ever say that this agrees with Nature?''

Since the Physical Universe is a finite whole, it is governed throughout by the basic Euclidean axiom, which pertains to all finite wholes: A part is less than the whole and the sum of the parts equals the whole.

Finally, let us try to dispel the myth that only professional physicists can learn, understand and criticize physics. In this century it was rumored that no more than six people could understand theories of modern physics, such as theory of relativity, quantum mechanics, etc. All rumors are not necessarily true. Likewise, the Reciprocal System of Physics and Philosophy can be learned even more easily, because clearer, by ANYONE, who cares to know about it and is prepared to examine and study it.

************** References **************
3) Larson, D. B., BASIC PROPERTIES OF MATTER, International Society of Unified Science, 1680 East Atkin Avenue, Salt Lake City, UT 84106

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